

## CLAIMS

What is claimed is:

- 1           1.       A method of forming a package, comprising:  
2                   placing a film against a flip-chip assembly, wherein the flip-chip assembly  
3           includes a die, an electrical connection, and a mounting substrate;  
4                   underfilling the die with underfill material;  
5                   curing the underfill material; and  
6                   after beginning curing the underfill material, removing the film.
- 1           2.       The method according to claim 1, wherein the film includes a tacky film.
- 1           3.       The method according to claim 1, wherein the film includes a tacky film, and  
2           wherein curing the underfill material is carried out under heat that causes the tacky film to  
3           release from the flip-chip assembly.
- 1           4.       The method according to claim 1, wherein after beginning curing the  
2           underfill material and removing the film, curing includes:  
3                   curing the underfill material that is in contact with the film;  
4                   removing the film; and thereafter  
5                   curing the underfill material that is between the die and the mounting  
6           substrate.

1           5.       The method according to claim 1, wherein after beginning curing the  
2 underfill material and removing the film, curing includes:  
3               curing the underfill material that is in contact with the film by conductive  
4 heat transfer from a mold press;  
5               removing the film; and thereafter  
6               curing the underfill material that is between the die and the mounting  
7 substrate by placing the package into a curing oven.

1           6.       The method according to claim 1, wherein after beginning curing the  
2 underfill material and removing the film, curing includes:  
3               heating the package in a curing oven under conditions to cause the tacky film  
4 to release from the flip-chip assembly.

1           7.       The method according to claim 1, wherein after beginning curing the  
2 underfill material and removing the film, curing includes:  
3               heating the package in a curing oven under conditions to cause the tacky film  
4 to release from the flip-chip assembly, wherein heating includes a first temperature  
5 ramp to a temperature range from about 100° C to about 180° C, a temperature hold  
6 at a temperature in this range, a second temperature ramp to a temperature range  
7 from about 140° C to about 260° C, and cooling.

1           8.       The method according to claim 1, wherein after beginning curing the  
2 underfill material and removing the film, curing includes:

3 heating the package in a curing oven under conditions to cause the tacky film  
4 to release from the flip-chip assembly, wherein heating includes a single step  
5 temperature ramp to a temperature in a range from about 140° C to about 240° C; and  
6 cooling.

1 9. The method according to claim 1, wherein the underfill material has a  
2 viscosity that causes it to draw between the die and the mounting substrate without the  
3 assistance of a pressure differential.

1 10. The method according to claim 1, wherein the underfill material has a  
2 viscosity that causes it to draw between the die and the mounting substrate, further  
3 including:  
4 flowing the underfill material from a first edge of the die to an opposite, second edge  
5 of the die by a pressure differential.

1 11. A method of forming a package, comprising:  
2 stretching a flexible film over die that is mounted on a mounting substrate to  
3 seal the flexible film thereupon;  
4 flowing underfill material between the die and the mounting substrate with a  
5 source and a vent;  
6 heating the underfill material to a first curing temperature; and  
7 after reaching the first curing temperature, removing the flexible film.

1           12.     The method according to claim 11, wherein the film is selected from a non-  
2 tacky film and a tacky film.

1           13.     The method according to claim 11, wherein the film includes a tacky film,  
2 and wherein heating the underfill material to a first curing temperature is carried out to cause  
3 the underfill material to cure, and wherein the first curing temperature is reached to a  
4 temperature range from about 100° C to about 180° C; and  
5           wherein the second curing temperature causes the tacky film to release from the die  
6 and mounting substrate, and wherein the second curing temperature is reached to a  
7 temperature range from 140° C to about 260° C.

1           14.     The method according to claim 11, wherein the film is a non-tacky film and  
2 wherein after heating the underfill material to a first curing temperature and removing the  
3 film, curing includes:  
4           gelling the underfill material that is in contact with the film;  
5           removing the film; and the process further including:  
6           curing the underfill material that is between the die and the mounting  
7           substrate.

1           15.     The method according to claim 11, wherein heating the underfill material to a  
2 first curing temperature includes:  
3           heating along a first temperature ramp to a first temperature range from about  
4           100° C to about 180° C; and further including:

5                   holding the first temperature;  
6                   heating along a second ramp to a temperature range from about 140° C to  
7                   about 260° C; and  
8                   cooling.

1           16.    The method according to claim 11, wherein the underfill material has a  
2           viscosity that causes it to draw between the die and the mounting substrate, further  
3           including:  
4           flowing the underfill material from a first edge of the die to an opposite, second edge  
5           of the die by a pressure differential.

1           17.    A chip package comprising:  
2           a die;  
3           a mounting substrate;  
4           an electrical connection disposed between the mounting substrate and the die;  
5           a cured underfill material including a fillet portion, and an interstitial portion  
6           disposed between the die and the mounting substrate, wherein the fillet portion  
7           includes a surface roughness and pattern that is characteristic of an interstitial film  
8           surface roughness and pattern.

1           18.    The chip package according to claim 17, wherein the interstitial film surface  
2           roughness and pattern is derived from a film selected from a tacky film and a non-tacky  
3           film.

1           19.     The chip package according to claim 17, wherein the fillet portion exhibits a  
2     single-stage solidification profile in cross section.

1           20.     The chip package according to claim 17, wherein the fillet portion exhibits a  
2     symmetrical rectilinear or other controllable footprint on the mounting substrate.

1           21.     The chip package according to claim 17, wherein the fillet portion exhibits a  
2     concave curvilinear cross-sectional profile.

1           22.     The chip package according to claim 17, wherein the electrical connection  
2     disposed between the mounting substrate and the die is selected from a ball grid array, a  
3     collapsed ball grid array, and a pin grid array.

1           23.     A chip-packaging process system comprising:  
2                   a die;  
3                   a mounting substrate;  
4                   an electrical connection disposed between the mounting substrate and the die;  
5                   a tacky film that is disposed over the die and stretched onto the mounting  
6     substrate;  
7                   a mold press that gives a shape to the film;  
8                   an underfill material disposed between the die and the mounting substrate;  
9     and  
10                  an underfill inlet and outlet system that communicates through the film.

1           24.     The chip-packaging process system according to claim 23, wherein the  
2 underfill inlet and outlet system includes an underfill conduit and a vent.

1           25.     The chip-packaging process system according to claim 23, wherein the  
2 underfill material includes a fillet shape disposed between the die and the mounting  
3 substrate, and wherein the a mold press that gives shape to the film includes a heater element  
4 disposed at the fillet.

1           26.     The chip-packaging process system according to claim 23, further including:  
2                 a first heating source for ramping the temperature of the underfill material to  
3                 a first cure state; and  
4                 a second heating source for causing the tacky film to release from the die, the  
5 fillet, and the mounting substrate.